TEGAM, INC.

SINGLE/DUAL CHANNEL HIGH VOLTAGE AMPLIFIER

MODEL 2340/2350

Instruction Manual

PN# 810044-CD
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REV. C

This owner's manual was as current as possible when this product was manufactured. However, products are constantly being updated and improved. Because of this, some differences may occur between the description in this manual and the product you received.

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Unpacking & Inspection:

Each 2340/2350 is put through a series of electrical and mechanical inspections before shipment to the customer. Upon receipt of your instrument unpack all of the items from the shipping carton and inspect for any damage that may have occurred during transit. Report any damaged items to the shipping agent. Retain and use the original packing material for reshipment if necessary.

Upon Receipt, inspect the carton for the following items:

1- Model 2340/2350 Dual Channel Voltage Amplifier
1- Model 2340/2350 User's Manual, P/N 810044-CD
1 or 2- High Voltage BNC to BNC cables (3ft)
1- Power Cord, P/N 600014

Safety Information & Precautions:

The following safety information applies to both operation and service personnel. Safety precautions and warnings may be found throughout this instruction manual and the equipment. These warnings may be in the form of a symbol or a written statement. Below is a summary of these precautions.

Terms in This Manual:

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

WARNING statements apply conditions or practices that could result in personal injury or loss of life.

Terms as Marked on Equipment:

CAUTION indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property including the equipment itself.

DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

Safety Information & Precautions Cont'd:

As Marked in This Manual:

	This symbol denotes where precautionary information may be found.

As Marked on Equipment:

	Attention – Please refer to the instruction manual.
	Danger – High or hazardous Voltage
	Earth Ground Terminal
I	On
O	Off
	Chassis Terminal
	Alternating Current

Grounding the Equipment
This product is grounded through the grounding conductor of the power cord.
WARNING: To avoid electrical shock or other potential safety hazards, plug the power cord into a properly wired receptacle before using this instrument.
The proper grounding of this instrument is essential for safety and optimizing instrument operation.

Danger Arising from Loss of Ground
If the connection to ground is lost or compromised, a floating potential could develop in the instrument. Under these conditions all accessible parts, including insulating parts such as keypads and buttons could develop a hazardous voltage and put the user at risk.

⚠

Use the Proper Fuse
To avoid fire hazard, use only the correct fuse type as specified for the AC power supply in this manual. Please note that the fuse rating for 100/120-volt operation is different than the rating for 200/240-volt operation. Information about the proper fuse type is also printed on the rear panel of the instrument.

Refer fuse replacement to qualified service personnel.

Do Not Use in Explosive Environments
WARNING: The 2340/2350 is not designed for operation in explosive environments.

Do not Operate Without Covers
WARNING: This device should be operated with all panels and covers in place.
Operation with missing panels or covers could result in personal injury.

⚠ **Outputs 1 and 2 have the potential to deliver high voltage and the necessary Precautions should be taken.**

FOR QUALIFIED SERVICE PERSONNEL ONLY

⚠ **Servicing Safety Summary:**

Do Not Service Alone
Do not perform service or adjustment on this product unless another person capable of rendering first aid is present.

Use Care When Servicing with Power On
Dangerous voltages may exist at several points in this product. To avoid personal injury or damage to this equipment, avoid touching exposed connections or components while the power is on. Assure that the power is off when removing panels, soldering, or replacing components.

Power Source
This product is intended to connect to a power source that will not apply more than 252V RMS between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

Power & Fuse Settings

CAUTION: DO NOT POWER THIS INSTRUMENT before verifying that the proper supply voltage settings have been made.
Be sure that the instrument is unplugged. There are two separate settings that need to be verified. Position the 2340/2350 so that you are facing the rear panel and follow the instructions below:

1. Make sure that the supply voltage switch is set for either 110 or 220 V operation in the rear panel. Then verify that the fuse rating is the correct value. The proper fuse rating is posted next to the line voltage selection switch. First remove the power cord and then check the fuse by taking a small straight edged screwdriver and inserting it into the fuse holder slot located below the power cord socket. Use the screwdriver to gently pry the fuse drawer until it slides out. Reinstall the fuse by simply pushing the fuse drawer back into its original position. You will here it snap into place.
2. Near the line voltage selection switch you will note another selection switch. This is the line voltage compensation switch. Adjust the position of this switch to the closest position that defines the actual line voltage. You may choose from LO line voltage (90-105/198-231V) or HI line voltage (108-126/216-252V). Once the proper settings have been verified, you may power the unit.

Important Safety Information:

The chassis of the 2340/2350 is grounded. The grounding shields of all the connectors are also grounded. This is for your safety.
WARNING: DO NOT MODIFIY any configurations or connections from their original state otherwise safe operation of this equipment may be compromised.

WARNING:
Always remember to shut of the power and wait at least 5 minutes before disconnecting or connecting any cables or connections to or from the Model 2340/2350. This warning also applies to any instruments having an electrical connection of any kind to the Model 2340/2350. This includes the signal source, load, and all ground and shield connections. Ignoring this warning could result in electric shock.

Intended use

The Model 2340/2350 Amplifier is a two-channel, high voltage amplifier capable of both sourcing and sinking current for a variety of loads including resistive and reactive loads. It was specifically designed for applications that require the output voltage range of standard signal or function generators to be extended beyond their typical range to ±200V. The 2340/2350 amplifier is compatible with virtually all types of signal and function generators.

Monitor Outputs

Each main output is accompanied by a monitor output. The monitor output is designed to provide an accurate, low-voltage representation of the amplifier output at a scale of 100:1 when feeding into a 1MΩ input and of 200:1 when feeding into a 50Ω input. The basic 2340/2350 amplifier gain is set to +50 with no inversion.

Voltage & Current Limitations

It should be noted that the maximum input of the 2340/2350 amplifier should not exceed ±4V. This would cause the output signal to exceed ±200V causing the output signal to clip resulting in severe distortion. The amplifier is protected in all operating modes with current limiting in either positive or negative directions. The maximum operating current of each output is rated for 40mA.

Frequency Characteristics

The 2340/2350 is capable of amplifying small signals from DC to 2MHz. The bandwidth of any amplifier decreases as the output amplitude approaches the instrument's maximum limits. There are several figures in the specification section of this manual that illustrate the frequency response, amplitude, output power and distortion characteristics of the 2340/2350. Included in these figures is a distortion versus frequency curve where the instrument's output is set to 75% of maximum amplitude (300Vp-p). Notice the steep frequency roll off when the amplifier's signal approaches its slew limitations. The 2340/2350 has a full power bandwidth that exceeds 200kHz.

Protection Circuits

The 2340/2350 amplifier has a LINE POWER switch and a power indicator on the front panel. The power indicator will illuminate when the high voltage DC supply is connected to the output power amplifiers. Under normal operation, the power indicator will illuminate approximately 2 seconds after the LINE POWER switch is turned on. However, if a high voltage DC fault occurs, the power supply monitor will protect the power amplifiers by disconnecting the high voltage supply from the output amplifiers. This will cause the power indicator to shut off. The fault will latch and the power indicator will remain off until the AC power is cycled to reset the fault. The 2340/2350 also has a current limit function to protect the outputs against short circuits etc.

Connections

The amplifier's inputs require standard BNC connections and have an impedance of 50Ω. This makes it compatible with all TEGAM-Pragmatic or other conventional signal generators. The output is specified at less than .2Ω. Two output cables are supplied with the 2340/2350. These are special cables, which have high-voltage BNC connectors on one end and standard BNC connectors on the other. The cables are designed for use with the high voltage output connectors on the front panel. There is a binding post available on the instrument's front panel to be used as a direct connection to the instrument's chassis. The monitor outputs may be connected using any standard type BNC to BNC cables to an oscilloscope, A/D card or other compatible monitoring device.

Instrument Specifications

Model 2340/2350 Specifications

Electrical Specifications	
Number of Channels	2
Input Impedance	50Ω Direct Coupled
Output Voltage Range	0 to ± 200V Direct Coupled
Maximum Output Current	40mA per channel
Output Impedance	< 0.2 Ω
Voltage Gain	+50 Fixed (Standard Unit)
Sine Wave Distortion (THD)	Refer to Figure 4
Small Signal Bandwidth	DC to 2MHz -Typical (-3dB) - Refer to Figure 1
Full Power	200kHz / 400 Vpp Sine - Typical (-0.1dB) (C_L<200pF)
Slew Rate	>250V/uSec
Square Wave Response Aberrations	< 0.8 µSec for 200 Volt Step < 2%
50Ω Voltage Monitor Outputs (One for each Channel)	50Ω Input Z (200:1 Ratio) > 1MΩ Input Z (100:1 Ratio)
Safety	Conforms with IEC 61010-1, CE Marked
Environmental	
Operating Temperature	0°C to +45°C, (32°F to 113°F) Ambient
Storage Temperature	-20°C to +50°C (-4°F to +122°F)
Humidity Range	< 80% RH Non-Condensing
General	
Input Supply Voltage	110/220 50/60 Hz – Rear Panel Selectable
Power Rating	100VA; 80W
Dimensions: (H x W x L)	4.51”x10.14”x11.81” (11.5 x 25.8x30.0 cm)
Weight (approximate)	10lbs (4.5kg)
Standard Accessories	User’s Manual; 2- BNC to High-Voltage BNC Cables (3ft); Power Cable

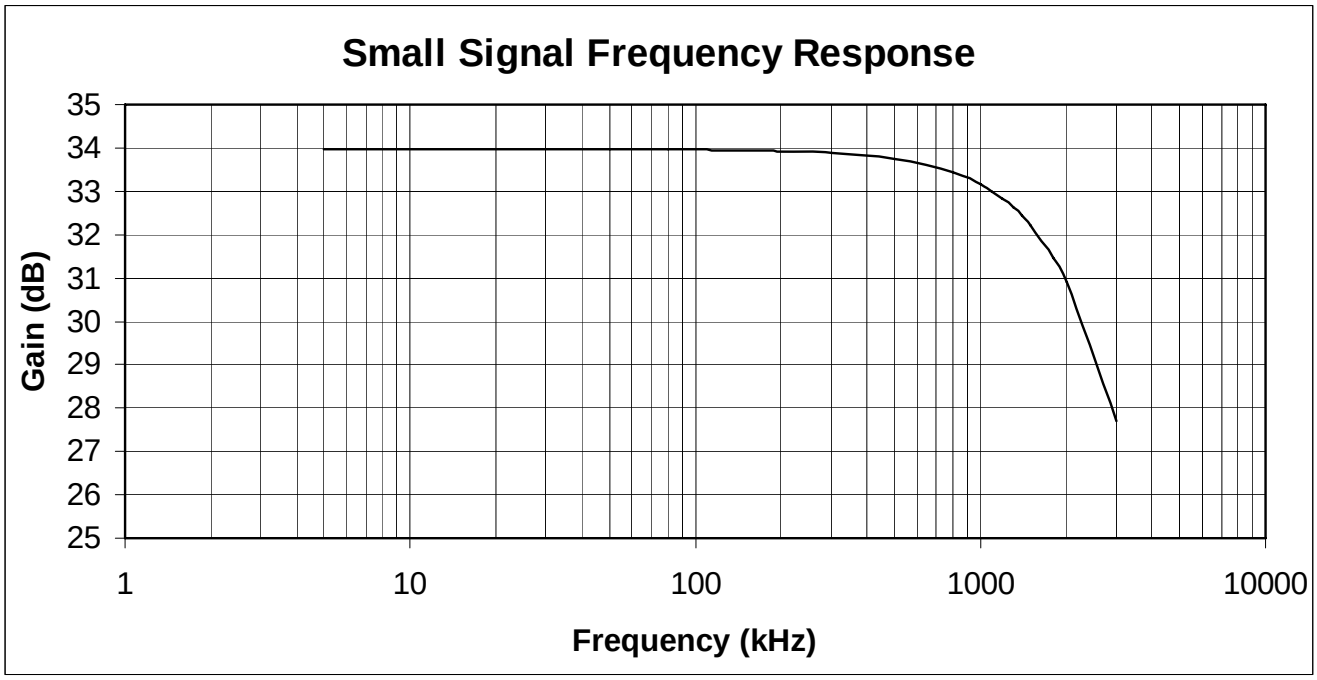


Figure 1: Small Signal Frequency Response (Typical)
Amplifier Gain measured with 900 mV peak-to-peak input.
Amplifier Frequency Response (-3 dB) at 2 MHz.

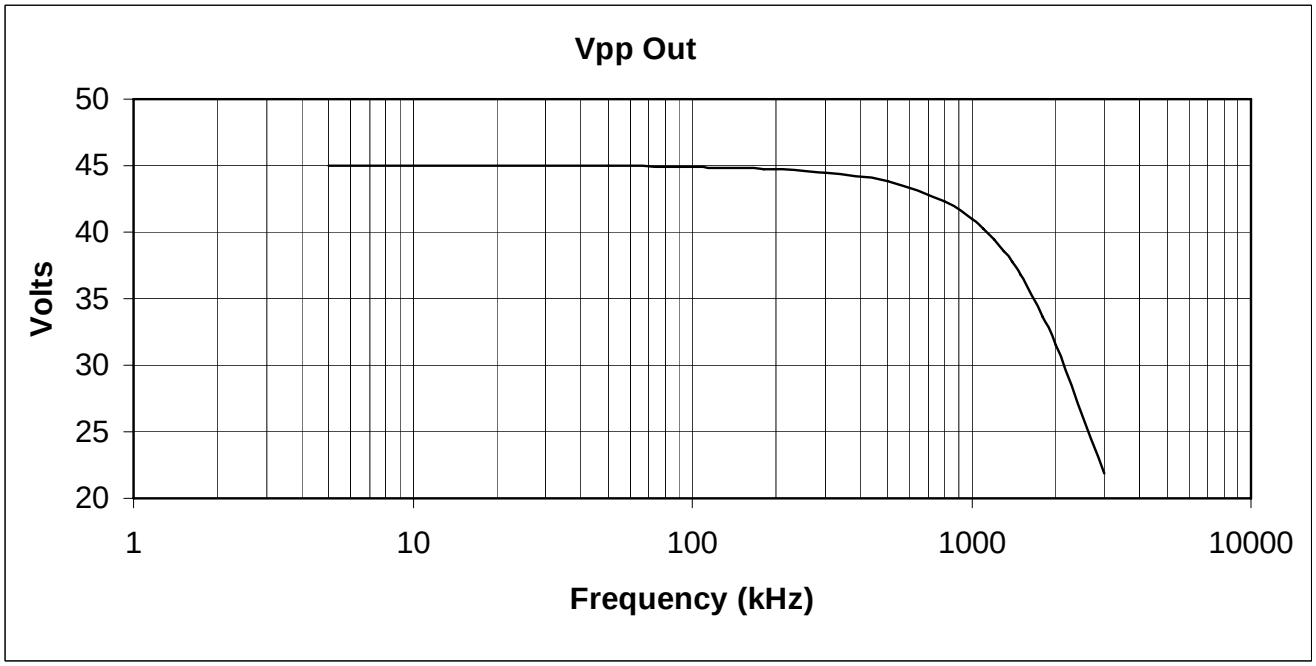


Figure 2: Small Signal Frequency Response (Typical)
Amplifier Gain measured with 900 mV peak-to-peak input.
Same as Figure 1 but Y-axis is Volts instead of dB

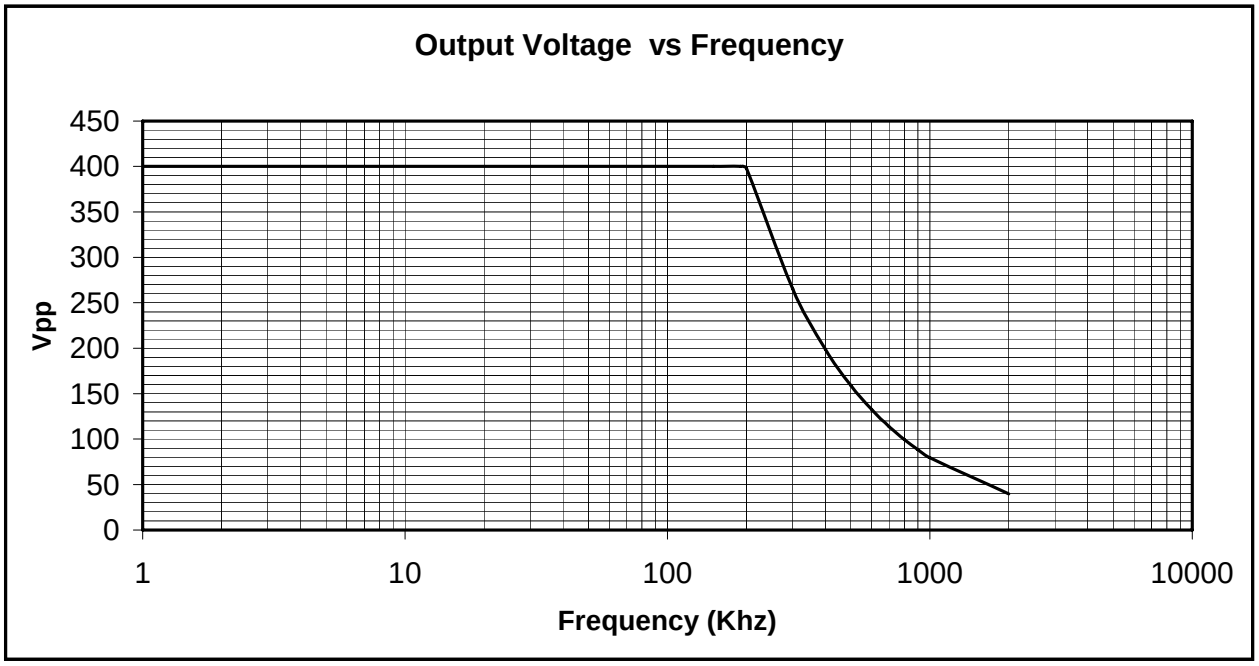


Figure 3: Maximum Voltage Out vs. Frequency
2340/2350 amplifier's maximum Vp-p output roll off with frequency.
The limitation is due to the amplifier's slew rate of 250 V/µSec

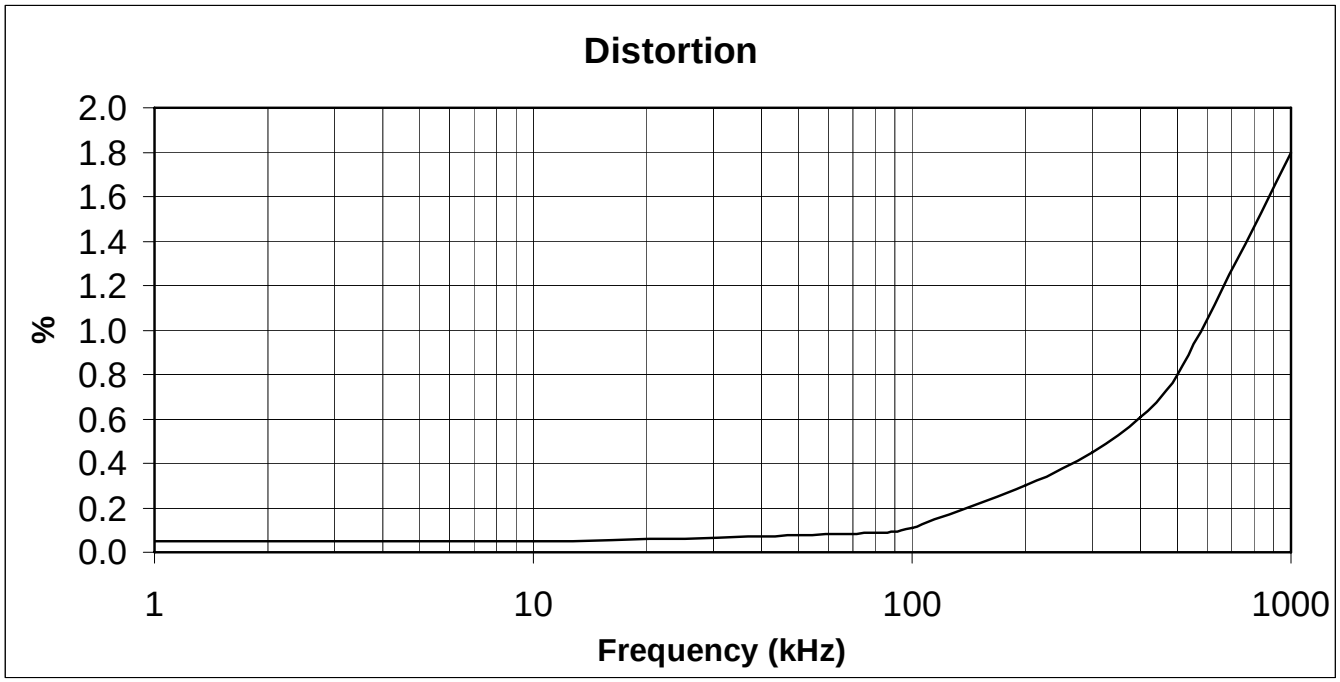
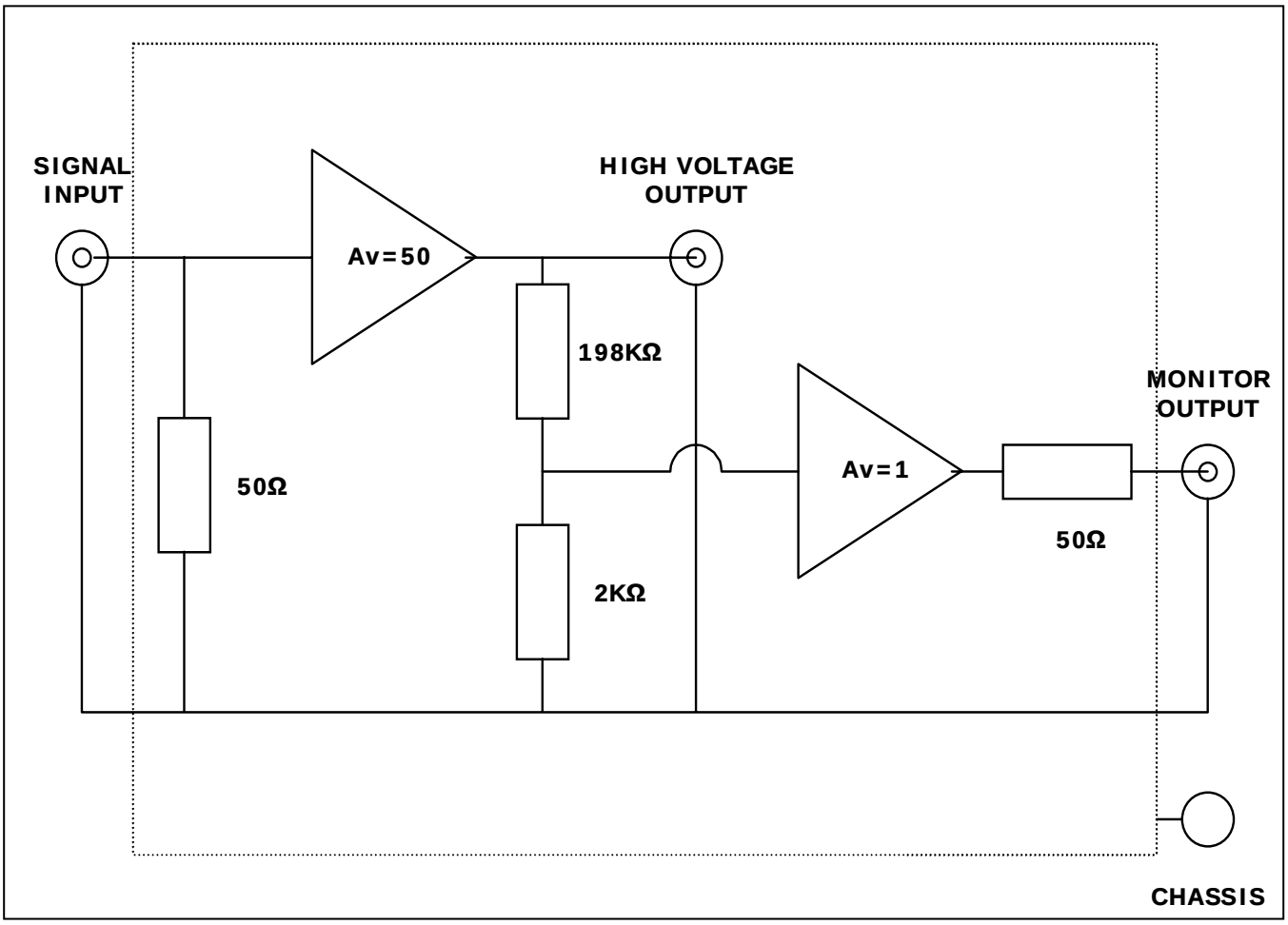


Figure 4: Distortion (Typical)
Distortion measurements made with the amplifier operating at 75% of the maximum Vp-p output obtained from Figure 3



Functional Block Diagram of 2340/2350 High Voltage Amplifier (1 Channel)

Warranty:

TEGAM, Inc. warrants this product to be free from defects in material and workmanship for a period of one year from the date of shipment. During this warranty period, if a product proves to be defective, TEGAM Inc., at its option, will either repair the defective product without charge for parts and labor, or exchange any product that proves to be defective.

TEGAM, Inc. warrants the calibration of this product for a period of 6 months from date of shipment. During this period, TEGAM, Inc. will recalibrate any product, which does not conform to the published accuracy specifications.

In order to exercise this warranty, TEGAM, Inc., must be notified of the defective product before the expiration of the warranty period. The customer shall be responsible for packaging and shipping the product to the designated TEGAM service center with shipping charges prepaid. TEGAM Inc. shall pay for the return of the product to the customer if the shipment is to a location within the country in which the TEGAM service center is located. The customer shall be responsible for paying all shipping, duties, taxes, and additional costs if the product is transported to any other locations. Repaired products are warranted for the remaining balance of the original warranty, or 90 days, whichever period is longer.

Warranty Limitations:

The TEGAM, Inc. warranty does not apply to defects resulting from unauthorized modification or misuse of the product or any part. This warranty does not apply to fuses, batteries, or damage to the instrument caused by battery leakage.

Statement of Calibration:

This instrument has been inspected and tested in accordance with specifications published by TEGAM Inc. The accuracy and calibration of this instrument are traceable to the National Institute of Standards and Technology through equipment, which is calibrated at planned intervals by comparison to certified standards maintained in the laboratories of TEGAM Inc.

Contact Information:

TEGAM INC.
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Equipment Maintenance

The cooling fan is designed for continuous operation. Periodically check the fan to make sure that airflow is not impeded and that there is adequate ventilation to keep the instrument cool.

TEGAM recommends that the 2340/2350 be calibrated and routine functional checks be performed on a regular basis. The recommended interval is every twelve months. The actual interval is dependent upon the application and is determined by your company's Quality Assurance policy.

Repair Parts

The Model 2340/2350 has no user replaceable parts.

Preparation for Repair or Calibration Service:

Once you have verified that the cause for 2340/2350 malfunction cannot be solved in the field and the need for repair and calibration service arises, contact TEGAM customer service to obtain an RMA, (Returned Material Authorization), number. You can contact TEGAM customer service via the TEGAM website, www.tegam.com or by calling 440.466.6100 (*All Locations*) OR 800.666.1010 (*United States Only*).

The RMA number is unique to your instrument and will help us identify your instrument and to address the particular service request by you which is assigned to that RMA number. Of even greater importance is a detailed written description of the problem that should be attached to the instrument. Many times repair turnaround is unnecessarily delayed due to a lack of repair instructions or of a detailed description of the problem.

This description should include information such as is the problem intermittent?, when is the problem most frequent?, has anything changed since the last time the instrument was used?, Etc. Any detailed information provided to our technicians will assist them in identifying and correcting the problem in the quickest possible manner. Use the form provided on the next page.

Once this information is prepared and sent with the instrument and RMA number to our service department, we will do our part in making sure that you receive the best possible customer serviced and turnaround time possible.

Expedite Repair & Calibration Form

Use this form to provide additional repair information and service instructions. The Completion of this form and including it with your instrument will expedite the processing and repair process.

RMA#:		Instrument Model #:	
Serial Number:		Company:	
Technical Contact:		Phone Number:	
Additional Contact Info:			

Repair Instructions:

☐ Evaluation ☐ Calibration Only ☐ Repair Only ☐ Repair & Calibration ☐ Z540 (Extra Charge)

Detailed Symptoms:

I*nclude information such as measurement range, instrument settings, type of components being tested, is the problem intermittent? When is the problem most frequent?, Has anything changed with the application since the last time the instrument was used?, etc.*

POWER AMPLIFIER OFFSET/GAIN CALIBRATION

Required Equipment:

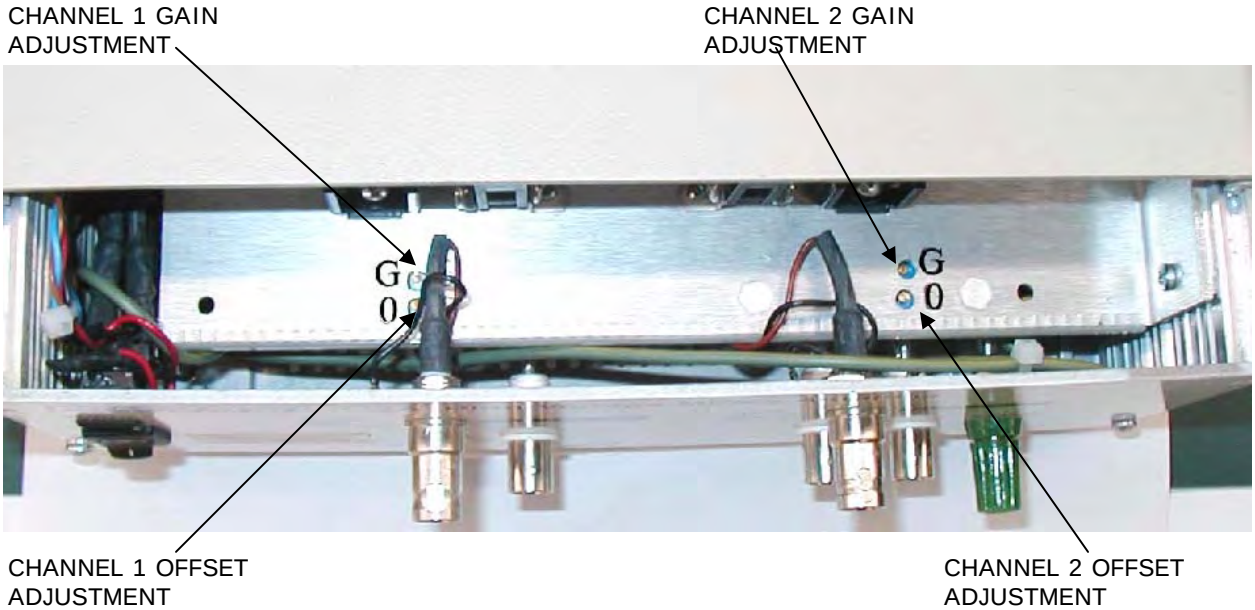
1. Function Generator
2. Fluke 8842A – 51/2 digit Digital Multimeter or equivalent
3. 50Ω BNC Splitter

WARNING: Servicing and calibration must be done by qualified service personnel.

WARNING: When disassembling the Amplifier for calibration, turn power OFF and disconnect the power cord from the AC power source.

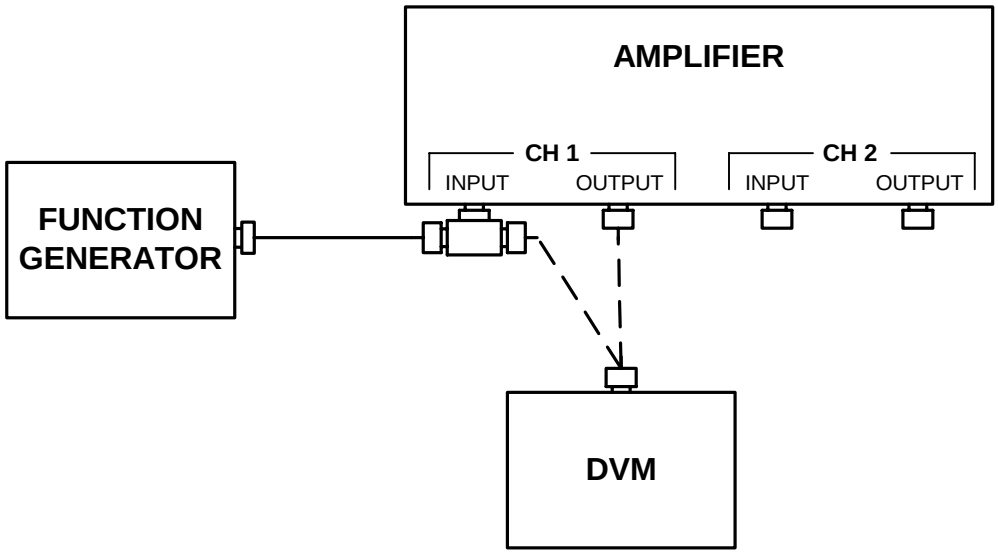
1. Remove the Amplifier's front and back bezels by pulling out on the left or right side to release the plastic from the metal sub panel. Rotate the released edge away from the panel 1 to 2 inches and move the bezel toward unreleased side and remove.
2. Remove the 2 top and 2 bottom sheet metal screws from the 4 corners of the rear panel.
3. Remove the 2 sheet metal screws from the 2 top corners of the front panel.
4. Carefully slide the rear panel out far enough so that the top cover can be grasped. Then slide the top cover back 3 to 4 inches so the offset and gain access hole adjustments at the front on the unit are visible. Refer to Figure 1
5. Before connecting the power cord to the Amplifier verify that all wiring is routed away from metal surfaces.

Figure 1 – Power Amplifier Gain/Offset Adjustments



POWER AMPLIFIER OFFSET/GAIN CALIBRATION Cont'd:

Figure 2 – Power Amplifier Gain/Offset Setup



6 Turn the 2340/2350 power ON and allow for the 2340/2350 to warm up for at least 15 minutes.
7 Verify that no instruments are connected to the Channel 1 or Channel 2 (*2350 only*) inputs.
8 Connect the DVM to Channel 1 OUTPUT and adjust the Channel 1 OFFSET potentiometer 0.0 ± 5 mVDC.
9 Apply a 4 Vpp (1.414 Vrms), 10 kHz, Sine wave to Channel 1 INPUT (with a BNC T-connector). Measure and ***[RECORD]*** the AC voltage with the DVM connected to the other end of the T-connector. Refer to Figure 2.
10 Multiply the recorded voltage from Step 9 by 50 and ***[RECORD]***.
11 Connect the DVM to Channel 1 OUTPUT and adjust Channel 1 GAIN potentiometer for the recorded voltage from Step 10 ± 0.2 Vrms.
12 If a dual channel amplifier is being calibrated, repeat Steps 7 through 11 for Channel 2.
13 Turn power OFF and disconnect the power cord from the AC power source.
14 Assemble the unit in the reverse order of disassembly.

Appendix

There is currently no supplementary information available at this time.